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# PERSPECTIVES

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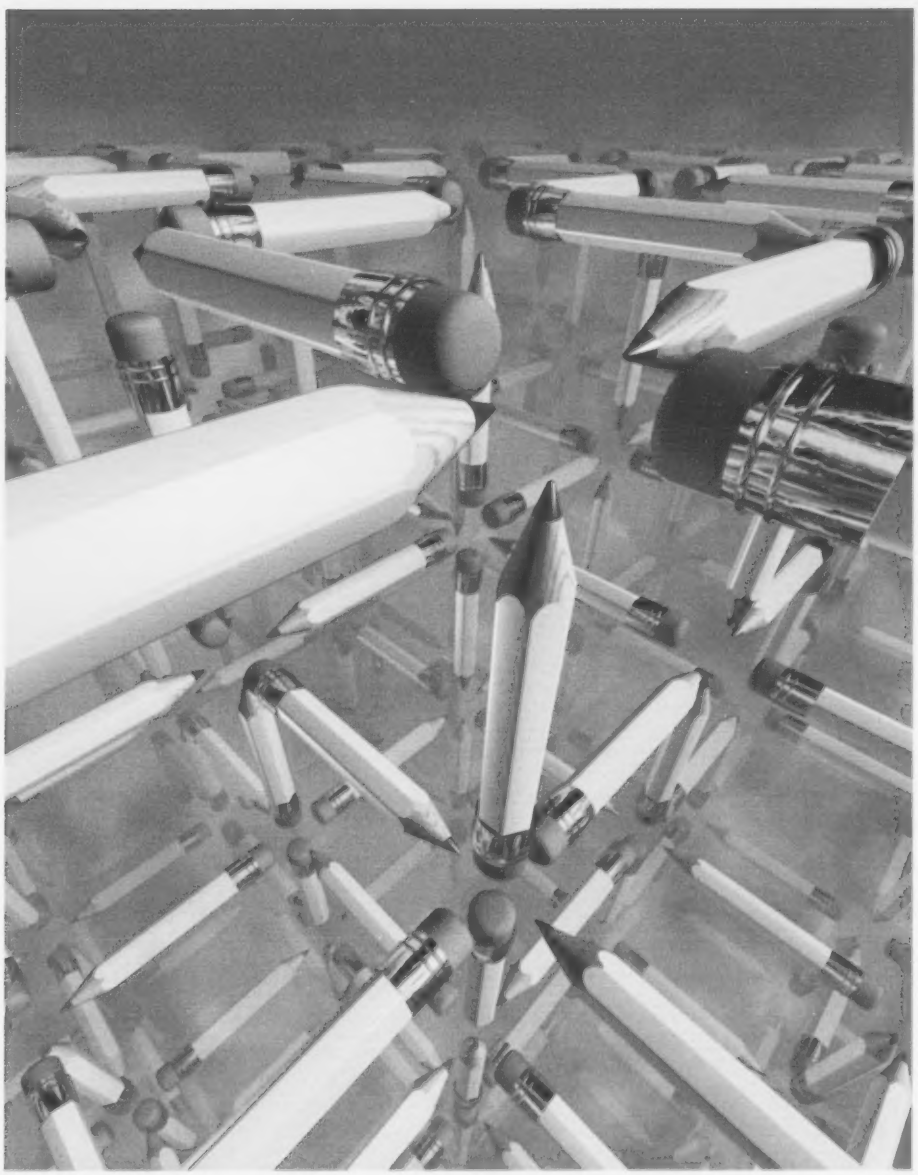
■ SOURCES OF WORKPLACE STRESS

■ PRODUCTIVITY AND PROSPERITY IN THE INFORMATION AGE



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# Highlights

## *In this issue*

### Sources of workplace stress

- In both 1994 and 2000, 34% of working Canadians cited too many demands or hours as the most common source of workplace stress.
- In 2000, about 37% of full-time workers felt stress at work as a result of too many demands or hours, compared with 20% of part-time workers.
- Almost one-quarter of employees working a rotating shift worried about accident or injury, compared with only 11% of daytime employees.
- Holding other factors constant, employees in health-related occupations were about seven times more likely than those in management, business, finance, or sciences to cite fear of accident or injury as a source of stress.
- Age has some influence on the type of workplace stress an individual experiences. For example, about 16% of workers 45 and older felt that having to learn computer skills was a source of stress, compared with only 8% of those aged 15 to 24.

### Productivity and prosperity in the information age

- In the late 1990s, the Canadian economy put on a remarkable performance. Economic growth was more rapid than in the 1981-1988 expansionary period (3.8% compared with 3.1%).
- Canada's increase in multifactor productivity in the 1990s improved not only relative to the U.S. but also by international standards.

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# Sources of workplace stress

*Cara Williams*

AN EMPLOYEE SITS AT HER DESK with numerous unread e-mail messages in her inbox, phone ringing, and a report to complete for the next morning. The demands of the job are making her anxious. At a nearby construction site, workers fear layoff as winter approaches. On the other side of town, a warehouse has begun using a computer-based inventory control system, and the staff are nervous about learning how to use it. These are just a few examples of sources of stress in the work environment.

Issues surrounding stress are continually in the media. Books on how to alleviate or live with stress are often bestsellers. But what is workplace stress? The Canadian Centre for Occupational Health and Safety defines workplace stress as the harmful physical and emotional responses that can happen when there is conflict between job demands on the employee and the amount of control an employee has over meeting these demands.

Work, family or other issues, alone or in combination, can lead to stress. While some stress is normal, research has shown that it can lead to the development of chronic conditions within a few years (Statistics Canada 2001). Other studies have shown that workers in high-strain jobs have higher rates of a wide variety of diseases than their counterparts in low-strain jobs (Wilkins and Beaudet 1998).

The costs of workplace stress are not limited to those who experience the stress. The Journal of Occupational and Environmental Medicine reports that health-care expenditures are nearly 50% greater for workers who report high levels of stress.[1] Prolonged stress can be costly to employers since it can result in increased absenteeism or a decline in productivity. For example, the 1990 Health Promotion Survey showed that absenteeism rose for employees who were concerned about interpersonal relations, job control, management practices, or safety. Additionally, the Canadian Policy Research Networks has estimated that stress-related absences cost employers about $3.5 billion each year (Duxbury and Higgins 2001).

The causes of stress are varied. In general, job stress is a result of the interaction between the worker and the conditions of work (NIOSH 1999). Perhaps the most commonly cited cause is a lack of time or an excessive workload (Chart). Lack of time may stem from responsibilities at home, at work, or a combination of both. But other triggers (or stressors) are possible. Working too much, fear of accident or injury, poor interpersonal relationships with co-workers or supervisors, or the threat of layoff or job loss can all be sources of stress in the work environment.

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**Chart: Triggers of workplace stress were similar in 1994 and 2000.**

*Source: General Social Survey*

## Data source and definitions

The **General Social Survey** (GSS) is an annual telephone survey covering the population 15 and over living in private residences in the 10 provinces. Data are collected from January to December. For the 2000 survey on access to and use of information technologies, the sample was about 25,000.

Questions on work environment stress triggers were asked only of those individuals who had worked sometime in the last 12 months. This resulted in a weighted count of about 16.9 million respondents 15 and older who had worked at some point in the previous 12 months.

**Full-time workers** are those who usually work 30 or more hours per week.

**Part-time workers** are those who usually work less than 30 hours per week.

**Shift workers** are those who do not have a regular daytime schedule.

**Work stress questions**
Has the following thing in your work environment caused you excess worry or stress in the past 12 months:

- too many demands or too many hours?
- risk of accident or injury?
- poor interpersonal relations
- threat of layoff or job loss?
- having to learn new computer skills?
- anything else?

The 1994 GSS on education, work and retirement had about 12,000 respondents. Respondents were asked about their work stress if they held a job at the time of the survey. This resulted in a weighted count of about 8.9 million respondents 15 and older who held a job at the time of the survey.

The workplace stress questions in 1994 were the same as in 2000, excluding the question that asked if respondents felt excess worry or stress in the past 12 months as a result of having to learn new computer skills.

The 1999 **Workplace and Employee Survey** (WES) was used to determine the percentage of employees with access to an employee assistance program. WES consists of two components: a workplace survey that aims to shed light on the relationships between competitiveness, innovation, technology use, and human resource management; and an employee survey that investigates technology use, training, job stability and earnings.

The reference period for WES was mainly the 12 months ending March 1999. The target population for the employer component is defined as all business locations with paid employees operating in Canada excluding Yukon, the Northwest Territories, and Nunavut. Also excluded are employers operating in crop and animal production; fishing, hunting, trapping; private households; and public administration. Just over 6,000 workplaces and about 24,000 employees responded to the survey.

The 1994 and 2000 General Social Surveys (see *Data sources and definitions*) looked at some of the triggers of workplace stress among employed Canadians. With particular focus on the more recent period, this article highlights some of the differences between the self-employed and employees, full-time and part-time employees, and occupation groups. It also examines whether certain demographic characteristics are associated with work environment stress triggers.

### Workers less worried about layoffs in 2000

In both 1994 and 2000, 34% of working Canadians cited too many demands or too many hours as the most common source of workplace stress. However, for various reasons, workplace stressors can change over time. For example, individuals may be more likely to cite certain triggers during times of economic contraction than during times of expansion. The GSS supports this idea. In 2000, when the economy was expanding and jobs were plentiful, only 13% of workers cited fear of job loss or layoff. Conversely, in 1994, with the economy emerging from a prolonged recession and the unemployment rate hovering around 10%, many Canadians were uncertain about their job security. This was undoubtedly a main reason why 22% of employees stated that fear of layoff or job loss was a source of workplace stress.

### Hours/demands most common source of workplace stress

Heavy workloads and long hours can infringe on time spent out of work. New technologies such as the Internet and e-mail have "permanently wired employees to their jobs" (MacBride-King and Bachmann 1999). Thus it is not surprising that too many demands or too many hours was the trigger of workplace stress cited most often by workers in 2000 (34%). In addition, 15% cited poor interpersonal relations, and 13% cited risk of accident and injury.

For some, new technologies can be a source of stress. As companies bring new technologies into the workplace, some people may feel threatened or ill at ease. This can be especially true for older workers or for workers in low-skill jobs. However, according to the 2000 GSS, only about 1 worker in 10 felt that having to learn new computer skills was a source of stress in the work environment.

As mentioned, sources of stress in the workplace can change with economic conditions. In 2000, the economy was growing, unemployment was decreasing,

wages were increasing, and many firms were hiring. Nevertheless, 13% of workers felt stressed by the fear of job loss or layoff. This source of stress may be well-founded since more than 4 in 10 of these individuals felt that it was somewhat likely or very likely that they would lose their job or be laid off sometime during the next year.

## The self-employed have different workplace stressors

Many Canadians have turned to self-employment as an alternative to traditional employment.[2] About 2.8 million Canadians were their own boss at some time during 2000. Reasons for choosing self-employment vary from individual to individual. For example, some may be unable to find other work, while others may feel the entrepreneurial pull. Whatever the reason, self-employment offers a different work environment.

But how does self-employment affect stress? Because self-employed individuals report only to themselves and have control over whom they work with, are they less likely than employees to feel stress as a result of poor interpersonal relations? Alternatively, because self-employed individuals rely on themselves, are they more likely to feel stressed because of too many hours?

Indeed, self-employed individuals were significantly less likely than employees to report poor interpersonal relationships (10% versus 16%), or fear of job loss (8% versus 14%) as a source of workplace stress. However, they were slightly more likely than employees to feel stress as a result of too many hours or too many demands in their work environment (37% versus 34%).

## Multiple workplace stressors for employees

Individuals may experience stress in their work environment from more than a single source. While about 26% of employees reported only one source and 16% reported two, more than 10% of employees cited three or more. This relatively high incidence of multiple stressors may be one of the reasons for the increasing popularity of employee assistance programs (see *Dealing with workplace stress*).

## Too many hours, too many demands: the universal plaint

Man or woman, young or old, full or part time, day or night shift, blue or white collar, the most commonly cited source of workplace stress for employees in 2000 was too many demands or hours. That said, within these groups were differences in the likelihood of experiencing certain stress triggers.

## Full-time workers

The vast majority of workers in Canada work full time. Of the 14 million employees[3] aged 15 and older, more than 80% regularly worked 30 or more hours a week. Perhaps because they spent more time at paid work, full-time employees were significantly more likely than part-time workers to cite stress triggers such as fear of injury, layoff, working too many hours, poor interpersonal relationships, or having to learn new computer skills (Table 1). Among full-time workers, almost half (47%) of those working long hours (over 40 hours per week) felt stress from too many demands or too many hours in their work environment.

## Rotating shift workers more likely to worry about accidents at work

Some research has shown that shift workers are more likely to have accidents or be injured on the job. Indeed, many of the worst industrial accidents have occurred in the early morning hours and are attributed to staff falling asleep or making bad decisions because of their substantial sleep deficit (Williams 2001).

Even though many shift workers put in a typical 8-hour day, the hours vary. So why are shift workers more prone to accident or injury? The answer is partly that they are unable to catch up on sleep. Some research has shown that night workers slept less during the day, and less deeply when asleep (Rosa and Colligan 1997). The accumulation of sleep debt can result in impaired judgment or delayed reaction time, which in turn can lead to accidents. Indeed, shift workers were more likely than daytime workers to state that they had sleep problems. About one-quarter of those who worked a regular night shift and one-third of those who worked a split shift stated that they routinely had problems falling sleep, compared with 14% of those with a regular daytime schedule.

It is therefore not surprising that virtually all types of shift workers were more likely than daytime workers to worry about accident or injury on the job. Indeed, almost one-quarter of employees working a rotating shift worried about accident or injury compared with only 11% of daytime employees (Table 1).

**Table 1: Workplace stressors by work schedule**

| | Total | Too many demands/ hours | Risk of accident/ injury | Poor interpersonal relations | Threat of layoff/ job loss | Having to learn computer skills | Other |
|---|---|---|---|---|---|---|---|
| | '000 | | | % | | | |
| **All workers** | **16,782** | **34** | **13** | **15** | **13** | **11** | **6** |
| Self-employed | 2,768 | 37 | 12 | 10 | 8 | 11 | 10 |
| Employees | 14,014 | 34 | 13 | 16 | 14 | 11 | 6 |
| Full-time | 11,547 | 37 | 14 | 17 | 15 | 12 | 6 |
| 30 to 35 hours | 1,855 | 29 | 11 | 15 | 15 | 11 | 6 |
| 36 to 40 hours | 6,085 | 33 | 14 | 17 | 16 | 12 | 6 |
| 41 hours or more | 3,608 | 47 | 16 | 18 | 13 | 13 | 6 |
| Part-time | 2,270 | 20 | 9 | 11 | 10 | 7 | 5 |
| 1 to 15 hours | 869 | 16 | 6 | 10 | 8 | 4[E] | 4[E] |
| 16 to 29 hours | 1,401 | 22 | 11 | 12 | 11 | 9 | 5 |
| Regular daytime | 9,532 | 35 | 11 | 15 | 14 | 12 | 6 |
| Shift | | | | | | | |
| Rotating | 1,834 | 35 | 24 | 20 | 16 | 11 | 5 |
| Regular evening or night | 1,360 | 27 | 16 | 16 | 12 | 5 | 4 |
| Irregular/split | 858 | 35 | 17 | 16 | 13 | 11 | 5[E] |
| Other/on call | 294 | 21 | 11[E] | 15[E] | 13[E] | F | 9[E] |

*Source: General Social Survey, 2000*
*Note: Percentages will not add due to multiple responses.*

Although shift workers and daytime workers differed in their worry over accident and injury on the job, equal percentages (35%) cited too many demands or hours in the work environment as a stress trigger. The exceptions were workers with a regular evening or night schedule and those who worked other types of schedules (including on-call). These individuals were slightly less likely to feel that too many demands or too many hours were a source of stress (27% and 21% respectively). Perhaps their schedules allowed them to better balance home and work. For example, individuals working a regular evening or night schedule may be at home during the day and able to meet their family or other responsibilities.

## Managers stressed over hours, primary workers worried about safety

Regardless of occupation, the most commonly cited source of stress was too many demands or hours (Table 2). That said, however, the likelihood of citing various stress triggers varied somewhat by occupation. Managers and professionals[4]—particularly in health-related occupations—were significantly more likely to report too many demands or hours compared with workers in manufacturing, processing, primary, or trades occupations.

Not surprisingly, because of the risk of infection from illness and disease coupled with long hours and irregular shifts, one-third of individuals in health-related occupations felt that the risk of accident or injury was a source of workplace stress. These workers were also much more likely than employees in general to cite multiple sources (42% versus 26%). Individuals in trades, transport and primary occupations were four times as likely as managers and professionals to report risk of accident or injury.

For many, computer technologies have changed the work environment. Certain occupations have been affected more than others. Professional occupations including those in the sciences, education, and health have the highest use of computers (86%) and primary occupations the lowest (24%) (Marshall 2001). This evolving technology requires constant skill upgrading, which many may find stressful. While only about 11% of employees overall felt stress as a result of having to learn computer skills, the percentage among employees in social sciences or education-related occupations was 20%.

Poor interpersonal relationships at work can also be very stressful. This is especially true in today's workplace where employees often have to work as

**Table 2: Sources of workplace stress by occupation**

| | Total | Too many demands/ hours | Risk of accident/ injury | Poor inter-personal relations | Threat of layoff/ job loss | Having to learn computer skills | Other |
|---|---|---|---|---|---|---|---|
| | '000 | | | | % | | |
| **Occupation** | **14,014** | **34** | **13** | **16** | **14** | **11** | **6** |
| Management | 902 | 48 | 5 | 17 | 12 | 13 | 6 |
| Business, finance and administrative | 2,586 | 38 | 6 | 17 | 16 | 17 | 6 |
| Natural and applied sciences | 950 | 45 | 8 | 16 | 18 | 17 | 7 |
| Health | 621 | 50 | 33 | 21 | 15 | 16 | 9 |
| Social science and education | 1,025 | 48 | 10 | 17 | 11 | 20 | 10 |
| Art, culture, recreation and sport | 312 | 25 | 10[E] | 16 | 13[E] | 12[E] | 7[E] |
| Sales and service | 3,624 | 28 | 13 | 16 | 12 | 7 | 4 |
| Trades, transport and equipment operators | 1,839 | 26 | 24 | 16 | 16 | 6 | 5 |
| Unique to primary industries | 378 | 24 | 20 | 10[E] | 12[E] | 7[E] | F |
| Unique to processing, manufacturing and utilities | 1,202 | 24 | 17 | 15 | 18 | 8 | 5 |

*Source: General Social Survey, 2000*
*Note: Percentages will not add due to multiple responses.*

part of a team. Even in jobs not requiring teamwork, relationships with co-workers, supervisors or clients can be stressful. Even though some occupations lend themselves to teamwork, the likelihood of feeling stressed at work as a result of poor interpersonal relationships did not vary significantly over most of the occupations examined. Occupations related to primary industry and health were the only exceptions. While 16% of employees overall considered poor interpersonal relations at work to be a source of stress, only about 10% of primary workers did so. At the other end of the spectrum were workers in health occupations with more than 20%.

## Age, sex and stress

Age or sex can influence the type of workplace stress an individual experiences. For example, young workers just entering the labour market may not feel the same pressures as mid-career workers. Similarly, stress triggers may differ for older workers, for men, or for women.

The advent of new technologies has eased communication and enabled firms to grow and evolve. However, for some employees, learning new technology can be stressful. Many young people have grown up with computers at home and at school and are comfortable with them. However, some older workers may find the new technology intimidating. About 16% of workers 45 and over felt that having to learn computer skills was a source of stress, compared with only 8% of those aged 15 to 24 (Table 3).

While learning computer skills may not be stressful to young workers, other things are. For example, 22% of young men felt that accident or injury was a source of stress in their work environment compared with about 15% of older men. Perhaps the explanation lies in the types of jobs held by young men or their relative inexperience.

Conversely, young employees were significantly less likely than their older counterparts to cite too many hours or too many demands as a source of stress in their work environment (25% versus 37%). This is not surprising given that these individuals are new entrants, often work only part time, and are not as likely to have the often conflicting demands of work and family.

Triggers of workplace stress also differ somewhat between men and women. While men and women had a similar likelihood of feeling stress because of poor interpersonal relationships, threat of job loss, or having to learn computer skills, the likelihood of citing other triggers varied. Women between 45 and 64, regardless of family structure, were significantly more likely than men the same age to feel workplace stress

**Table 3: Sources of workplace stress by age and sex**

| | Total | Too many demands/ hours | Risk of accident/ injury | Poor interpersonal relations | Threat of layoff/ job loss | Having to learn computer skills | Other |
|---|---|---|---|---|---|---|---|
| | '000 | | | | % | | |
| **Total all ages** | **14,014** | **34** | **13** | **16** | **14** | **11** | **6** |
| 15 to 24 | 389 | 25 | 18 | 16 | 17 | 8[E] | F |
| Men | 265 | 25 | 22 | 16 | 17 | 10[E] | F |
| Women | 124 | 25 | F | 18[E] | 17[E] | F | F |
| 25 to 34 | 2,062 | 37 | 15 | 17 | 15 | 10 | 5 |
| Men | 1,218 | 37 | 17 | 17 | 16 | 10 | 6 |
| Women | 844 | 38 | 12 | 18 | 14 | 10 | 4[E] |
| 35 to 44 | 2,818 | 37 | 12 | 16 | 15 | 12 | 6 |
| Men | 1,506 | 36 | 15 | 15 | 16 | 11 | 6 |
| Women | 1,312 | 39 | 9 | 17 | 14 | 13 | 6 |
| 45 to 54 | 2,072 | 38 | 13 | 15 | 16 | 15 | 6 |
| Men | 1,029 | 35 | 15 | 16 | 16 | 15 | 5 |
| Women | 1,044 | 41 | 11 | 15 | 16 | 16 | 7 |
| 55 to 64 | 813 | 34 | 12 | 13 | 12 | 16 | 6 |
| Men | 330 | 25 | 12 | 10[E] | 9[E] | 11[E] | 6[E] |
| Women | 483 | 40 | 12 | 15 | 14 | 18 | 6[E] |

*Source: General Social Survey, 2000*
*Note: Percentages will not add due to multiple responses.*

as a result of too many demands or hours. At virtually all ages, men were more likely to cite fear of accident or injury.

## Regression analysis

Logistic regression was used to examine the relationship between two common workplace stressors and a number of explanatory variables (Table 4).[5] With few exceptions, both models confirmed that most variables had a significant influence on the likelihood of feeling stress in the workplace as a result of too many hours or demands, or fear of accident or injury, when all other variables were held constant. Not surprisingly, work status, occupation, and work schedule were strong predictors of stress in the workplace. The odds of feeling stress as a result of fear of accident or injury were 7.2 times higher for employees working in health occupations than for those in management, business, finance and science occupations.

Other important contributors to these two stressors were age and sex. For example, men were significantly less likely than women to feel stress in their work environment as a result of too many demands or hours, but they were 1.3 times more likely to feel stress from fear of accident or injury.

Conversely, analyses indicate that married employees or those with children under 15 in the household were not significantly more likely to feel stress in the workplace because of too many demands or hours.

## Summary

The effects of stress are well documented. While occasional bouts of stress are not likely to have lasting adverse health effects, regular or constant stress is more likely to have negative health implications.

The most common source of workplace stress cited by working Canadians in 1994 and 2000 was too much time at work or too many demands. However, given the economic situation of the early 1990s, it is not surprising that almost one-quarter of workers in 1994 said that fear of layoff or job loss was a source of workplace stress.

Workplace stress triggers varied depending on work structure and characteristics. For example, both the self-employed and full-time workers were significantly more likely to feel the time crunch of too many demands or hours at work, compared with their employee and part-time counterparts. Stress triggers

**Table 4: Odds of feeling stress in the workplace**

| | Odds ratio[†] | |
|---|---|---|
| | Too many demands/hours | Risk of accident or injury |
| **Sex** | | |
| Men | 0.860 ** | 1.296 *** |
| Women | 1.0 | 1.0 |
| **Age** | | |
| Under 35 | 1.426 *** | 1.288 ** |
| 35 to 54 | 1.628 *** | 1.225 * |
| 55 and over | 1.0 | 1.0 |
| **Children 14 and under in household** | | |
| Yes | 1.085 | 0.975 |
| No | 1.0 | 1.0 |
| **Marital status** | | |
| Married or common-law | 1.007 | 0.932 |
| Divorced, widowed, separated | 0.983 | 0.962 |
| Single, never married | 1.0 | 1.0 |
| **Work status** | | |
| Part-time | 0.445 *** | 0.642 *** |
| Full-time | 1.0 | 1.0 |
| **Work schedule** | | |
| Regular daytime | 0.903 * | 0.579 *** |
| Shift work | 1.0 | 1.0 |
| **Occupation** | | |
| Management, business, finance and sciences | 1.0 | 1.0 |
| Health-related occupations | 1.612 *** | 7.150 *** |
| Social sciences, culture and sales | 0.866 ** | 2.032 *** |
| Trades, primary, processing and manufacturing | 0.507 *** | 3.453 *** |

*Source: General Social Survey, 2000*

† *Odds ratios are generated from a logistic regression. They indicate whether certain levels of an explanatory variable, compared with the reference category, increase or decrease the odds of a certain event occurring while controlling for all other explanatory variables. Separate models were used for feeling stress in the work environment as a result of too many demands or too many hours or as a result of fear of accident or injury.*

*Statistically significant at: * .05 ** .01 *** .001*

also differed according to work schedule. One-quarter of rotating shift workers worried about the risk of accident or injury on the job compared with about 10% of daytime workers.

Occupation also played a key role. Other factors constant, employees in health occupations were over seven times more likely than those in management, business, finance or science occupations to cite fear of accident or injury as a source of stress. Stress triggers also varied by demographic characteristics such as age and sex. In general, women felt stressed about too many hours or demands at work, while men worried more about accident or injury on the job. Finally, older workers worried much more than younger workers about learning computer skills.

In an attempt to address the human and financial costs associated with stress, many employers have implemented employee assistance programs. The 1999 Workplace and Employee survey found that 26% of private-sector employees had access to such programs.

**Perspectives**

## Notes

1 As cited on the National Institute for Occupational Safety and Health Web site: www.cdc.gov/niosh/stresswk.html (accessed May 13, 2002).

2 According to the Labour Force Survey, between 1990 and 1997, self-employment accounted for over 75% of total job growth.

3 Individuals who reported that they had worked *sometime* in the last 12 months.

4 Business, finance, administrative; health; natural and applied sciences; and education occupations.

5 Certain variables were excluded and other categories, such as occupation, were re-grouped into larger groups for the regression analyses.

6 The 2001 Canadian Mental Health Survey was conducted by COMPAS on behalf of the Canadian Mental Health Association.

7 For a list of types of employees surveyed, see *Data sources and definitions.*

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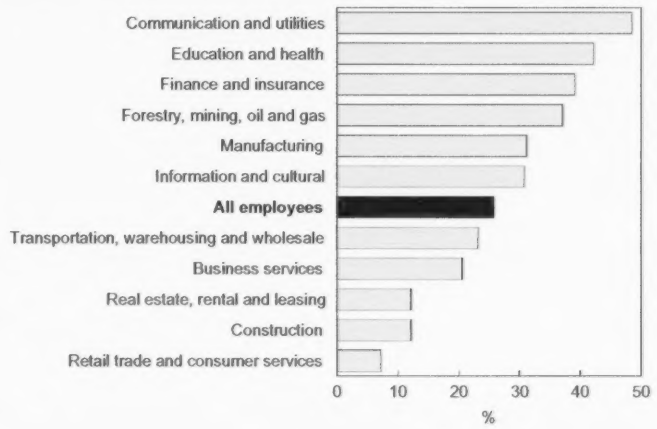
## Dealing with workplace stress

Stress in the workplace is common. The 2001 Canadian Mental Health Survey[6] found that 51% of respondents felt that work was a major or moderate source. But not all stress is negative; research has shown that individuals function best in a work setting that places reasonable demands on them. One example of positive stress might be preparing for a job interview. While the preparation may be stressful, getting the resulting promotion is perceived for the most part as a positive event. And many Canadians view stress in a positive light. Indeed, about 4 in 10 respondents in the Canadian Mental Health Survey said that the amount of workplace stress they experienced had a positive effect on their performance, while about 3 in 10 felt it had a negative effect.

As workplace stress triggers vary, so do strategies for dealing with them. Good job design is important. The Canadian Centre for Occupational Health and Safety believes that a job should be reasonably demanding, with at least a minimum of variety in job tasks, that employees should be able to learn on the job, and that the job should allow some decision making.

Because stress has become such an important issue, many employers have instituted programs and policies to reduce stress or help employees deal with stress before it becomes a problem. Indeed, the 1999 Workplace and Employee Survey found that slightly more than one-quarter (26%) of employees[7] had access to some type of employee assistance plan. These rates were even higher in certain industries. For example, 49% of employees in communication and utilities industries reported having access to an employee assistance program (see Chart). At the lower end, the figure was about 7% for employees in the retail and services industries. However, these programs have recently come under fire for dealing only with the symptoms of workplace stress and not taking the extra step to address the causes (Rosolen 2002). For example, many employers provide programs to deal with the stress of working long hours, but do little to bring about change to lighten the workload.

**More employees in the communication and utilities industries had access to employee assistance programs.**

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# Productivity and prosperity in the information age

*Kaïs Dachraoui, Tarek M. Harchaoui and Faouzi Tarkhani*

In the late 1990s, the Canadian economy put on a remarkable performance. After 1995, economic growth was more rapid than in the 1981-1988 expansionary period (3.8% compared with 3.1%).[1] Both unemployment and inflation remained unusually low. Previously, low levels of unemployment usually meant sharply rising inflation. Yet, despite an unemployment rate in 1999 and 2000 of only about 7%, core inflation remained in check at 2.3%. Federal budget deficits vanished, as the structural budget balance moved steadily from deficit to surplus. And Canada's productivity performance compared favourably with that of the United States.

Productivity is not only the key to the performance of firms and industries, it is fundamental to living standards. During the late 1990s, Canada experienced a transformation in its productivity record. The causes and industry origins of the surge are not well known. Recent Statistics Canada studies provide some useful insights, not only reaffirming the role of information technology, but also revealing the mechanisms by which it has operated. This article draws heavily on that research to describe productivity trends, the role of different industries and information technology in the recent acceleration, and the implications for Canada's prosperity.

### *Key features of Canada's business sector productivity performance*

Canada's productivity surge in the 1990s has been highlighted in a number of previous studies (Crawford 2002; OECD 2001). A few key features are summarized here.

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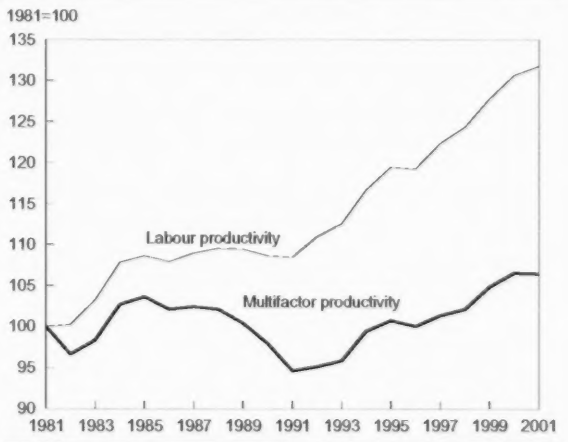
Two productivity measures for the business sector are presented: labour productivity—the amount of output produced per unit of labour used; and multifactor productivity—the amount of output produced per unit of combined input of labour and capital (buildings, machinery, equipment). Improvements in productivity imply increased efficiency—that is, labour and capital resources are used in ways that add more value.

Canada's productivity performance over the 1981-2001 period went through three phases: strong growth from 1981 to the mid-1980s, a pronounced deceleration to the early 1990s, then a renewed surge (Chart A).

The 1990s surge peaked in 2000. Productivity declined slightly in 2001, as the business sector recorded a 0.9% increase in output and a 1% increase in combined labour and capital input. The 1990s presented the longest period of continuous growth in multifactor productivity during the last 20 years.

**Chart A: Business sector productivity picked up sharply after 1995.**

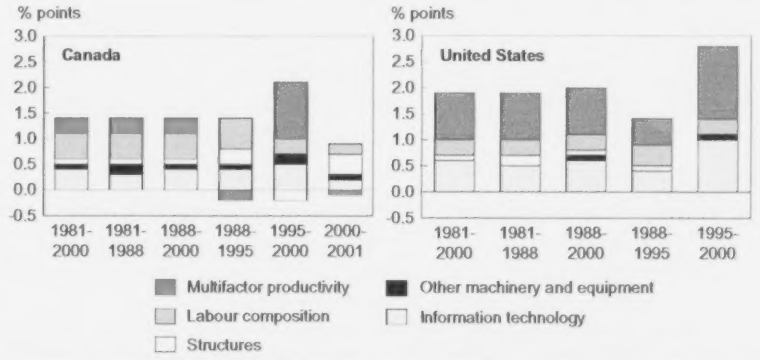



*Source: Canadian Productivity Accounts*

Since 1980, Canada and the United States have been through two business cycles (1981 to 1988, and 1988 to 2000). The 1980s were similar to the 1990s in both Canada and the U.S. in that labour productivity growth remained virtually unchanged (Chart B). Both periods saw a productivity gap in favour of the U.S. (about 0.5 percentage point).

During the 1980s and the 1990s in Canada, labour composition—which captures the increasing importance of skilled workers—was the largest contributor to labour productivity, followed by increases in information technology capital intensity and multifactor productivity growth. In contrast, in the U.S., multifactor productivity growth drove the labour productivity increase, followed by information technology capital intensity, and labour composition.

**Chart B: Multifactor productivity became more significant after 1995.**




*Sources: Canadian Productivity Accounts; U.S. Bureau of Labor Statistics*

### *Methodology*

A number of U.S. studies have looked at the contribution of information technology to productivity growth. For brevity, however, this paper focuses on comparisons with contributions based on the U.S. Bureau of Labor Statistics (BLS) data, because the Canadian Productivity Accounts uses similar methods, and access to the BLS dataset allows the choice of comparison periods.

Computers, telecommunication systems and the Internet have brought revolutionary changes to businesses, consumers, education, health, entertainment and many other aspects of life. A defining characteristic is the greatly reduced costs of storing, accessing and exchanging information. This has reduced the costs of coordination, communications and information processing, and, increasingly, has also facilitated changes in what businesses do and how they do it.

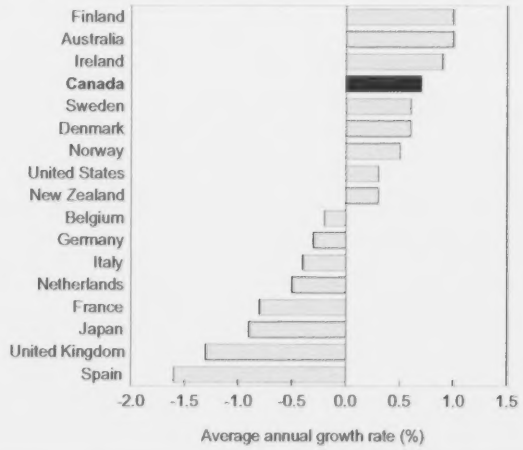
Of particular interest have been the links between information technology and productivity growth. The framework provides three avenues for information technology to influence labour productivity:

**Increases in capital intensity**. Labour productivity can rise as a result of higher capital use per unit of labour. Stronger investment in information technology can raise capital intensity.

**Productivity gains in information technology production**. Producers' ability to manufacture much more powerful information technology equipment, with little increase in inputs, generates substantial multifactor productivity gains. If the gains are of sufficient magnitude and production is on sufficient scale, they can show up as contributions to aggregate multifactor productivity growth.

**Productivity gains in industries using information technology.** This implies that use of information technology generates multifactor productivity gains.

**Chart C: Canada ranked near the top for business sector multifactor productivity revival in OECD countries.**




*Source: OECD, 2001*

*Note: Change in average annual growth rate from 1980-1989 to 1990-1999. The Canadian figures in this chart are not comparable to those reported elsewhere in this article.*

Between the early and late 1990s, labour productivity growth increased from 1.2% to 1.8% in Canada, largely as a result of the multifactor productivity revival. In contrast, owing to a surge in information technology capital intensity and multifactor productivity growth, the U.S. labour productivity growth doubled (from 1.4% to 2.8%) between these two periods.

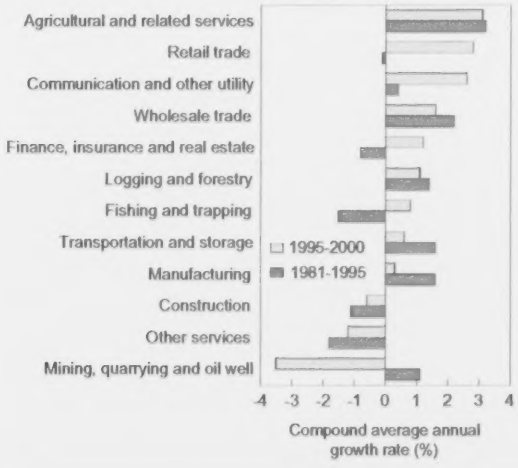
Canada's increase in multifactor productivity in the 1990s improved not only relative to the U.S. but also by international standards (Chart C). Canada ranked fourth among the nine OECD countries to experience productivity acceleration in the 1990s.

A convenient way to assess the breadth of the Canadian productivity revival is to examine the productivity performance of industries in the business sector (Chart D). For the 12 broad sectors, the changes in average productivity growth rates between the 1981-1995 and the 1995-2000 periods differ, ranging from a drop of 3.5% in mining, quarrying and oil well to a gain of 3.1% in agricultural and related services.

The multifactor productivity growth revival during the late 1990s was not confined to one sector—retail trade; communication and utilities; and finance, insurance, and real estate all saw strong gains. At the same time, two major sectors, manufacturing and wholesale trade, experienced a productivity deceleration.

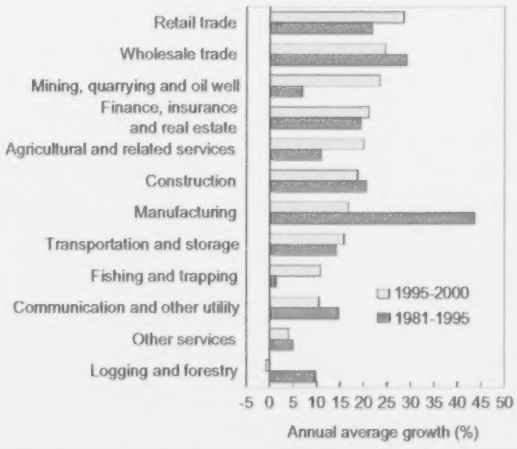
Part of the success of some industries was linked to information technology. For example, the financial sector restructured to operate much more through ATMs and Internet and telephone banking rather than through traditional face-to-face contact. Similarly, retailers were able to use bar-code and scanning technology and inventory management systems as part of a process that transformed wholesaling from a storage-based to a fast flow-through operation. These two industries reported the highest growth of information technology capital intensity during the late 1990s (Chart E).

**Chart D: Most industries experienced a multifactor productivity revival after 1995.**




*Source: Canadian Productivity Accounts*

**Chart E: Information technology capital expanded in virtually all industries.**




*Source: Canadian Productivity Accounts*

### *Prosperity in the economy as a whole*

What has the productivity surge meant for average incomes and the distribution of income in Canada?

Using labour productivity,[2] a simple relationship illustrates just how important productivity growth is to prosperity, measured as per capita GDP.[3]

$$\frac{GDP}{Persons} = \frac{GDP}{Hours\ worked} \cdot \frac{Hours\ worked}{Employees} \cdot \frac{Employees}{Persons}$$

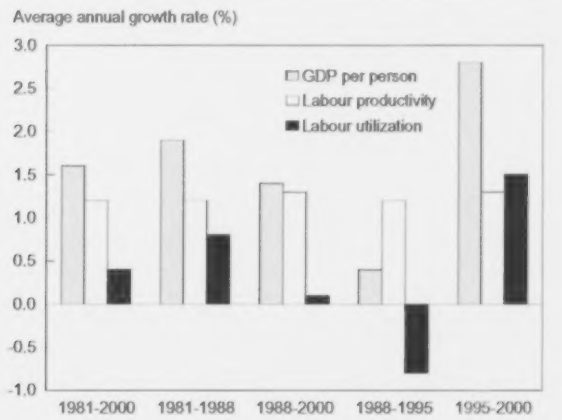
Or, in other words,

*GDP per capita = Labour productivity*
*• Average hours worked • Employment ratio*
*Labour utilization*

The last two terms on the right-hand side are sometimes combined and referred to as the rate of labour utilization (OECD 2001). This measures the extent to which the population is actively engaged in employment activity—hours worked per capita.

During the 1990s, real income advanced at 1.4%, down from 1.9% during the 1980s, a reflection of a slower growth in labour utilization—from 0.8% in the 1980s to 0.1% in the 1990s (Chart F). In contrast, labour productivity growth remained virtually unchanged between these two periods. The 1990s brought a major turnaround in Canada's prosperity growth, even though it remained unchanged between the early and late 1990s.

**Chart F: Canada's standard of living improved sharply after 1995.**




*Source: Canadian Productivity Accounts*

Changes in labour utilization in the late 1990s boosted average real income, which grew at a remarkable 2.8% per year. When real income grows at this pace, each generation experiences a far more affluent lifestyle than the previous one. Over the course of a lifetime, parents can provide their children with a standard of living that is twice the level they themselves enjoyed as children.

Perspectives

## Notes

1 This study uses the most recent annual data (September 2002) for productivity over the 1981-2000 period. Data are current as of July 2002 and reflect a downward revision in U.S. productivity estimates as of March 2002. More information on the revisions can be found at www.statcan.ca/english/concepts/15-204/productivity.pdf.

2 The coverage of the labour productivity measure differs in this section (whole economy output and hours worked) from that used in the previous section (business sector output and hours worked). The business sector measures are generally considered to be more representative of productivity trends since they exclude activities (such as government administration) for which output is hard to measure.

3 Labour productivity is a measure subject to a number of well-known criticisms as a welfare indicator, but it is a meaningful and useful indicator nonetheless.

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